

MICROFICHE: ALL-5020

(replaces microfiche GENERAL of 4.86,
distributed in English only).

System: L-Jetronic LB, 0 280 00. ...
Various vehicles as from 1983 (US market)

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© 1993 Robert Bosch GmbH Customer Service Vehicle
Equipment, Department for Technical Publications
KH/VDT, Postfach 50, D-7000 Stuttgart 1

Published by: Customer Service Department for Training
and Technology (KH/VSK). Press date: 9.1993

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SPECIAL FEATURES

This microfiche contains the L-Jetronic fault detection for vehicle models (→ 1983) with 4, 6 or 8-cylinder engines.

The test is carried out with the universal test adapter.

VEHICLE MODEL	ENGINE	CONTROL UNIT NUMBERS
ALFA ROMEO		
Spider 2.0 i.e.	1,962 l/ 4Cyl.	0 280 000 206/221
GTV 6 2.5 i.e.	2,492 l/ 6Cyl.	0 280 001 113/131/132
BMW		
3.0 Si	2,986 l/ 6Cyl.	0 280 001 102/106
3.0 CSi	2,986 l/ 6Cyl.	0 280 001 102
528 i	2,788 l/ 6Cyl.	0 280 001 112/118/122
630 CSi	2,986 l/ 6Cyl.	0 280 001 106
633 CSi/ 733 i	3,210 l/ 6Cyl.	0 280 001 111/122
FIAT		
Brava 2000	1,995 l/ 4Cyl.	0 280 000 190
124 Sport Spider	1,995 l/ 4Cyl.	0 280 000 190/207/222
X 1/9 1500 i.e.	1,499 l/ 4Cyl.	0 280 000 191/208/223
Strada i.e.	1,499 l/ 4Cyl.	0 280 000 191
LANCIA		
Beta HPE 2000 i.e.	1,995 l/ 4Cyl.	0 280 000 174/216
OPEL		
Manta 1.9 E	1,900 l/ 4Cyl.	0 280 000 107
PORSCHE		
912 2.0 E	1,960 l/ 4Cyl.	0 280 000 134
928 4.7	4,664 l/ 8Cyl.	0 280 002 104
RENAULT		
18 1.6 i	1,647 l/ 4Cyl.	0 280 000 196/210
Fuego 1.6 i	1,647 l/ 4Cyl.	0 280 000 210
Fuego 1.6 i Turbo	1,565 l/ 4Cyl.	0 280 000 215
TRIUMPH		
TR 7	1,998 l/ 4Cyl.	0 280 000 187/199
VOLKSWAGEN		
Vanagon 2.0	1,971 l/ 4Cyl.	0 280 000 178/180/192



Special Note

- L-Jetronic with 35 pole control unit. Injection triggering at control unit term. 1 through ignition coil term. 1. 7 pole air flow sensor and 13 pole relay combination or 7 pole control relay with main relay.

Note:

The L-Jetronic system in these vehicle models essentially corresponds to that of the Fiat 2.0 l / 4 cyl.

- as in SIS Fault diagnosis instructions
SIS Microcard FIA-01/J22

Important Information

Test specifications are always found on this microcard.

Rapid test list for universal test adapter

- Universal test adapter 0 684 101 801
- Adapter line 1 684 463 129

The following rapid test list makes it possible for the experienced L-Jetronic expert to quickly test the electrical part of the system using the universal test adapter.

The rapid test list contains the following information:

- Sequence of test steps
- Initial positions on the universal test adapter
- Notes on how to operate the universal test adapter or other equipment
- Test specifications for the motortester and multi-meter.



Rapid test list for universal test adapter ETT 018.01

Testing of L-Jetronic with adapter line 1 684 463 129

Test step	Switch		Testing of components / function	Control unit plug between terminals	Test information / test conditions	Test specifications (Reading)
	V	Ω				
1	3	-	Voltage from ignition/starting switch term. 50	4 and 5	Shift gear to neutral and operate starting motor	<u>8 ... 15 V</u>
2	4	-	Voltage from relay combination term. 88c or control relay term. 87b over the auxiliary air device. Not used by Porsche 928 and vehicles with water-heated aux. air slides.	34 and 5	Shift gear to neutral and operate starting motor	<u>8 ... 15 V</u>
3	5	-	Voltage pulses from ignition coil term. 1.	1 and 5	Shift gear to neutral and operate starting motor	Ignition pulses on oscilloscope (primary signal).
4	6	-	Voltage relay combination term. 88a or main relay term. 87b.	10 and 5	Ignition on	<u>8 ... 15 V</u>
5	7	-	Voltage from 1st electric injection valve term. 15	15 and 5	Ignition on	<u>8 ... 15 V</u>
6	8	-	Voltage from 2nd electric injection valve term. 33	33 and 5	Ignition on	<u>8 ... 15 V</u>
7	9	-	Voltage from 3rd electric injection valve term. 32	32 and 5	Ignition on	<u>8 ... 15 V</u>
8	10	-	Voltage from 4th electric injection valve term. 14	14 and 5	Ignition on	<u>8 ... 15 V</u>
9	11	-	Voltage over pump contact in the air flow sensor from relay combination term. 86b (not used by air flow sensors without pump contact).	20 and 5	Ignition on Sensor flap open.	<u>8 ... 15 V</u>
10	12	-	Voltage from relay combination term. 88b or term. 86b (Not used with electric injection valves with series resistor).	29 and 5	Ignition on	<u>8 ... 15 V</u>

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Rapid test list for univ. adapter
Different US-vehicles with L-Jetronic



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Rapid test list for univ. adapter
Different US-vehicles with L-Jetronic



Rapid test list for universal test adapter (Continuation)
Testing of L-Jetronic with adapter line 1 684 463 129

Test step	Switch		Testing of components / function	Control unit plug between terminals	Test information / test conditions	Test specifications (Reading)
	V	Ω				
11	13	-	Voltage from 5th elec. injec. valve term.30. Not used by 4 or 8 cyl. veh.	30 and 5	Ignition on.	<u>8 ... 15 V</u>
12	14	-	Voltage from 6th elec. injec. valve term.31. Not used by 4 or 8 cyl. veh.	31 and 5	Ignition on.	<u>8 ... 15 V</u>
13	↓	6	Resistance value of the potentiometer in the air flow sensor term. 7.	7 and 5	Displace sensor flap	Up to 6/80 40 ... 300 Ω from 6/80 80 ... 600 Ω
14	↓	7	Resistance value of the potentiometer (total resistance value in air flow sensor term. 8).	8 and 5	----	Up to 6/80 130... 260 Ω from 6/80 260... 520 Ω
15	↓	8	Series resistor values and potentiometer total resistance value in the air flow sensor term. 9.	9 and 5	----	Up to 6/80 200... 400 Ω from 6/80 400... 800 Ω
16	↓	9	Resistance value of the idle contact in the throttle valve switch term. 2.	2 and 18	Accelerator in rest position	<u>0 ... 10 Ω</u>
					Press accelerator a little	<u>∞ Ω</u>
17	↓	10	Resistance value of the full load contact in the throttle valve switch term. 3.	3 and 18	Accelerator in rest position	<u>∞ Ω</u>
					Press accelerator down fully	<u>0 ... 10 Ω</u>

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Rapid test list for univ. adapter
Different US-vehicles with L-Jetronic



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Rapid test list for univ. adapter
Different US-vehicles with L-Jetronic



Rapid test list for universal test adapter (Continuation)

Testing of L-Jetronic with adapter line 1 684 463 129

Test step	Switch		Testing of components / function	Control unit plug between terminals	Test information test conditions	Test specifications (Reading)
	V	Ω				
18	↓	11	Resistance values of the temperature sensors NTC I in the air flow sensor term. 27. (Not used by Opel 1900 E)	27 and 5	----	at +15°C...+30°C: 1.45...3.3 k Ω at +80°C: <u>280...360 Ω</u>
19	↓	12	Resistance value of the temperature sensor NTC II term. 13 (engine temperature).	13 and 5	----	at +15°C...+30°C: 1.3...3.6 k Ω at +80°C: <u>250...390 Ω</u>
20	↓	13	Resistance value between ground and ground term. 16	16 and 5	----	<u>0 ... 10 Ω</u>
21	↓	14	Resistance value between ground and ground term. 17.	17 and 5	---	<u>0 ... 10 Ω</u>
22	↓	15	Resistance value between ground and ground term. 35. (Not used by all vehicle types)	35 and 5	---	<u>0 ... 10 Ω</u>
23	↓	16	Resistance value of the air pressure switch term. 26. (Only vehicles with turbocharger).	26 and 5	Subject air pressure switch to approx. 1000...1500 mbar over-pressure.	<u>0 ... 10 Ω</u>
24	↓	8	Resistance of altitude sensor. Total resistance at term. 2 and term. 3 of the altitude sensor. (Only for vehicles with altitude sensor).	9 and 5	Remove 5/7 pole plug-in connection of air flow sensor for measurement.	<u>2.3 ... 2.8 kΩ</u>
25	↓	19	Resistance value of altitude sensor. Resistance at term. 1 and term. 2 of the altitude sensor. (Only for vehicles with altitude sensor).	12 and 5	Remove 5/7 pole plug-in connection of air flow sensor for measurement. Resistance is not linear.	at 977 mbar (ca. 300 m high) <u>2,0 2,5 kΩ</u> at 616 mbar (ca. 4000 m high) 2,2 2,7 k Ω

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Rapid test list for univ. adapter
Different US-vehicles with L-Jetronic



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Rapid test list for univ. adapter
Different US-vehicles with L-Jetronic



Rapid test list for universal test adapter
(Continuation)

Notes

The following components with respective terminal leads are not tested by the universal test adapter:

- | | |
|-----------------------|--|
| 1. Cold start valve | terminal leads 46 and 47 |
| 2. Thermo-timeswitch | terminal leads 45 and
ground connection |
| 3. Electric fuel pump | terminal leads from term. 88d
of the relay combination and
ground connection |



Test specifications

Pressure regulator

- Fuel pressure
general except Opel 1900 E 2.3 ... 2.7 bar
Opel 1900 E 2.8 ... 3.2 bar

Electric fuel pump

- Fuel delivery at return

Alfa Romeo	Spider 2.0 i.e.	650 cm ³ /30 s
	GTV 6 2.5 i.e. .	1000 cm ³ /30 s
BMW	3.0 Si 3.0 CSi) 528i 530i) 630 CSi 633 CSi) 733i)	1000 cm ³ /30 s
Fiat	Strada i.e.) X 1/9 1500 i.e.) Brava 2000) 124 Sport Spider)	650 cm ³ /30 s 1000 cm ³ /30 s
Lancia	Beta HPE 2000 i.e.	1000 cm ³ /30 s
Opel	Manta 1.9 E	750 cm ³ /30 s
Porsche	912 2.0 E 928 4.7	500 cm ³ /30 s 1100 cm ³ /30 s
Renault	18 1.6 i/Fuego 1.6 i Fuego 1.6 i Turbo	600 cm ³ /30 s 700 cm ³ /30 s
Triumph	TR 7	500 cm ³ /30 s
Volkswagen	Vanagon 2.0	750 cm ³ /30 s

- Terminal voltage under load min. 12 V.



Test specifications

Thermo time switch (35°/8s):

● Internal electrical resistance	Between "G" term. and ground	Between "W" term. and ground	Between "G" term. and "W"
Ambient temp. under +30°C	25...40 Ω	0Ω	25...40 Ω
working temp. over +40°C	50...80 Ω	100...160Ω	50...80 Ω

Cold start valve

- internal resistance 3.5...4.5 Ω
- leakage: max. allowance 1 drop/min.

Auxiliary air slide

- internal resistance 25...75 Ω

Temperature sensor

● internal resistance	NTC I air	NTC II motor
Ambient temp. (+15°C...+30°C):	1.45...3.3 kΩ	1.30...3.6 kΩ
Working temp. (ca. +80°C):	280...360 Ω	250...390 Ω



Test specifications

Electric injection valve (at +20°C)

- Internal resistance 2.0...3.0 Ω

Air pressure switch Only with vehicles with turbocharger

- Resistance value
 - at atmospheric pressure $\infty \Omega$
 - at ca.1000...1500 mbar over-pressure 0 Ω

Air flow meter

- Resistance value

Contac on air flow meter	to 6/80	from 6/80
term. 6 - term. 9	200 ... 400 Ω	400 ... 800 Ω
term. 6 - term. 8	130 ... 260 Ω	260 ... 520 Ω
term. 8 - term. 9	70 ... 140 Ω	140 ... 280 Ω
term. 6 - term. 7	40 ... 300 Ω^*	80 ... 600 Ω^*
term. 7 - term. 8	100 ... 500 Ω^*	200 ... 1000 Ω^*

* The reading of the meter changes with the opening of the sensor flap.

Altitude sensor (Only in vehicles with altitude sensor)

300 m high (977 mbar) : 2.0... 4.0 V
4000 m high (616 mbar) : 8.0...12.0 V

- Resistance between term. 2 (-) and term. 3 (+): 2.3...2.8 k Ω



Test specifications

Relay combination

- Resistance between term. 86b (plus) and term. 85:

0 332 514 105

50 ... 110 Ω

0 332 514 121/127

70 ... 500 Ω

Idle speed adjustment

Engine warm, ca. 80°C

- Idle speed
manual trans
automatic trans
 - CO adjustment, content
- } Technical data refer to vehicle manufacturer
Ex. from info plate in the engine compartment

Lambda

- Integrator voltage

Lambda tester 0 684 101 810 (KDJE-P600) or corresponding voltmeter ($R_I \geq 20k\Omega/V$) connected to test pin of term. 22 of control unit.

Closed-loop control, with connected lambda probe:

volt reading fluctuates between two readings.

Open-loop control, with disconnected lambda probe:

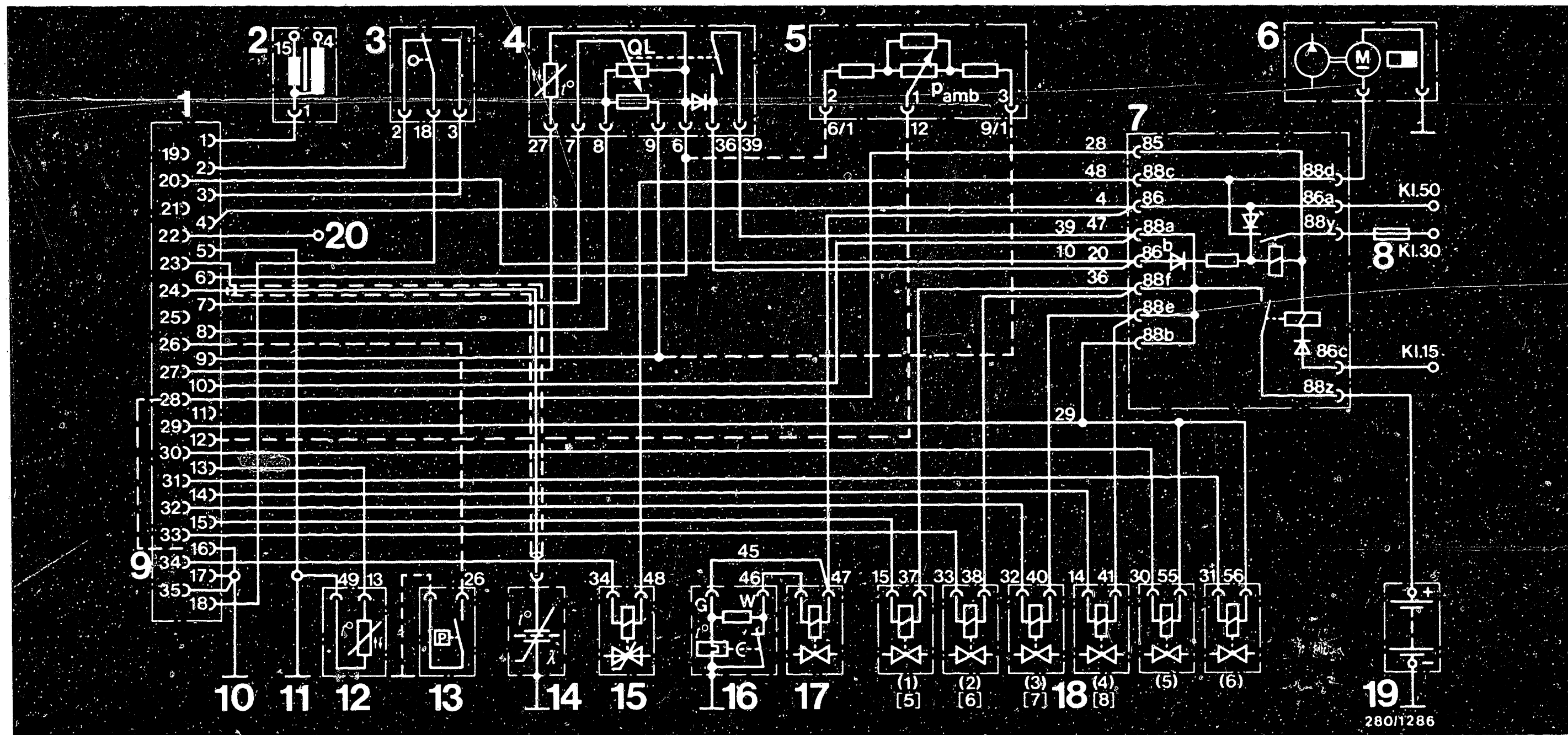
volt reading must be in the middle

Rich stop unplug probe and connect lead of control unit to ground 10...12 V

Lean stop press 0.9V button (connect the 2V output of the lambda tester to lead of control unit) ca. 0.5 V

During the CO check, switch on the extraction system. Test values for ignition systems, valve clearance and other basic engine test data see Autodata microcard.





ELECTRICAL WIRING DIAGRAM (Current regulating output stage)

- | | | | |
|---|--|---|--|
| 1 = Control unit multi plug | 6 = Fuel pump | 10 = Output stage ground | 16 = Thermo time switch |
| 2 = Ignition coil | 7 = Relay combination (those ending in 105 are without term. 88f + diode 03) | 11 = Sensor ground | 17 = Cold-start valve |
| 3 = Throttle valve switch | 8 = Fuel pump fuse | 12 = Temp. sensor II (motor) | 18 = Electric injection valves (5,6,7,8) only with 8-cyl. vehicles |
| 4 = Air flow sensor | 9 = Cable links in control unit | 13 = Air pressure switch only w. turbocharger | 19 = Battery |
| 5 = Altitude sensor (only in veh. with altitude sensor) | | 14 = Lambda sensor | 20 = Test pin (integr. volt) |
| | | 15 = Aux. air slide | |

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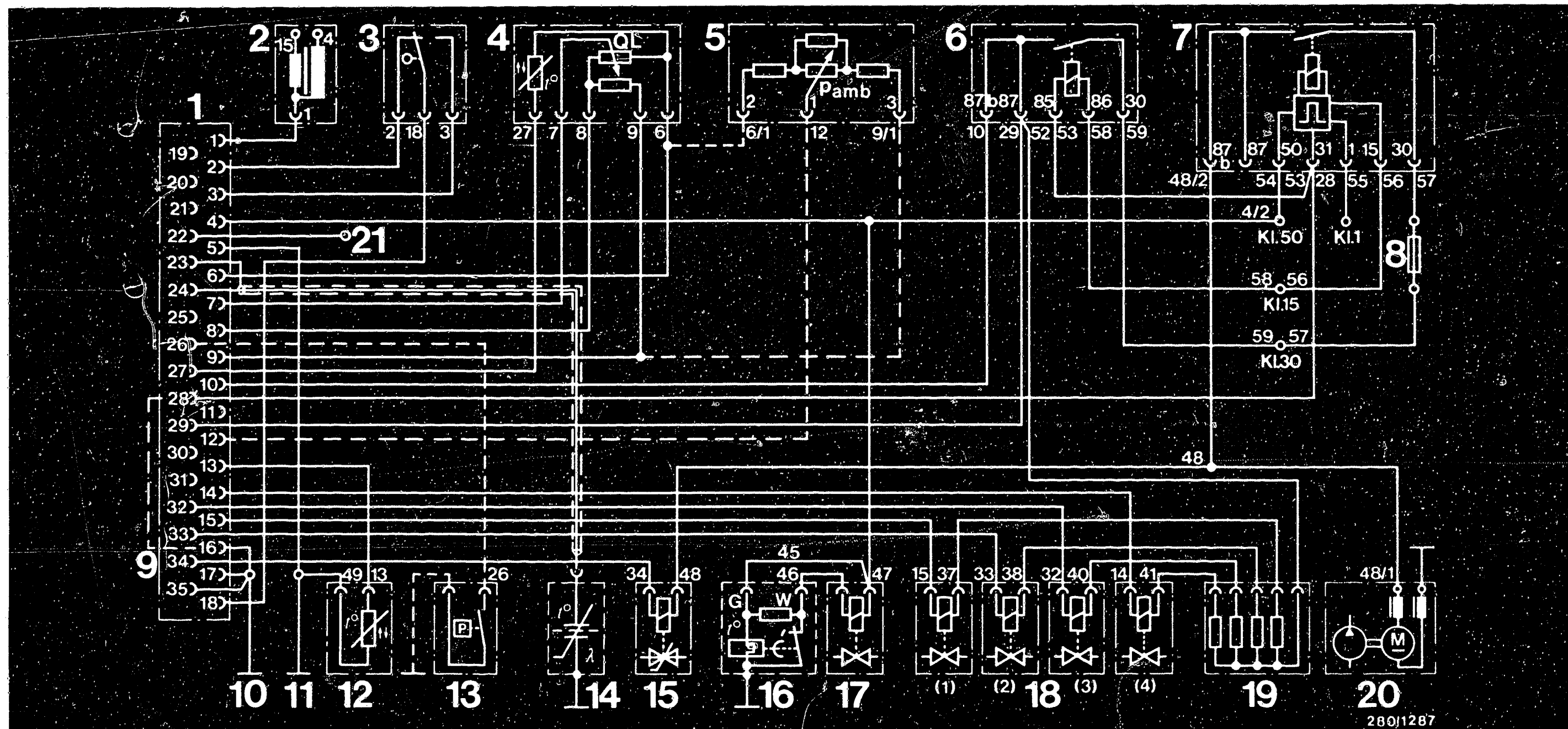
Terminal diagram
Different US-vehicles with L-Jetronic



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Terminal diagram
Different US-vehicles with L-Jetronic





ELECTRICAL DIAGRAM (Standard output stage with series resistors, control relay and main relay)

- | | | | |
|---|---------------------------------|---|--------------------------------|
| 1 = Control unit multi plug | 6 = Main relay | 11 = Sensor ground | 16 = Thermo time switch |
| 2 = Ignition coil | 7 = Control relay | 12 = Lambda sensor | 17 = Cold-start valve |
| 3 = Throttle valve switch | 8 = Pump fuel fuse | 13 = Air pressure switch (only in veh. with turbocharger) | 18 = Electric injection valves |
| 4 = Air flow sensor | 9 = Cable links in control unit | 14 = Temp. sensor II (motor) | 19 = Series resistor |
| 5 = Altitude sensor (only in veh. with altitude sensor) | 10 = Output stage ground | 15 = Aux. air slide | 20 = Fuel pump |
| | | | 21 = Test pin (integr. volt) |

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Terminal diagram

Different US-vehicles with L-Jetronic

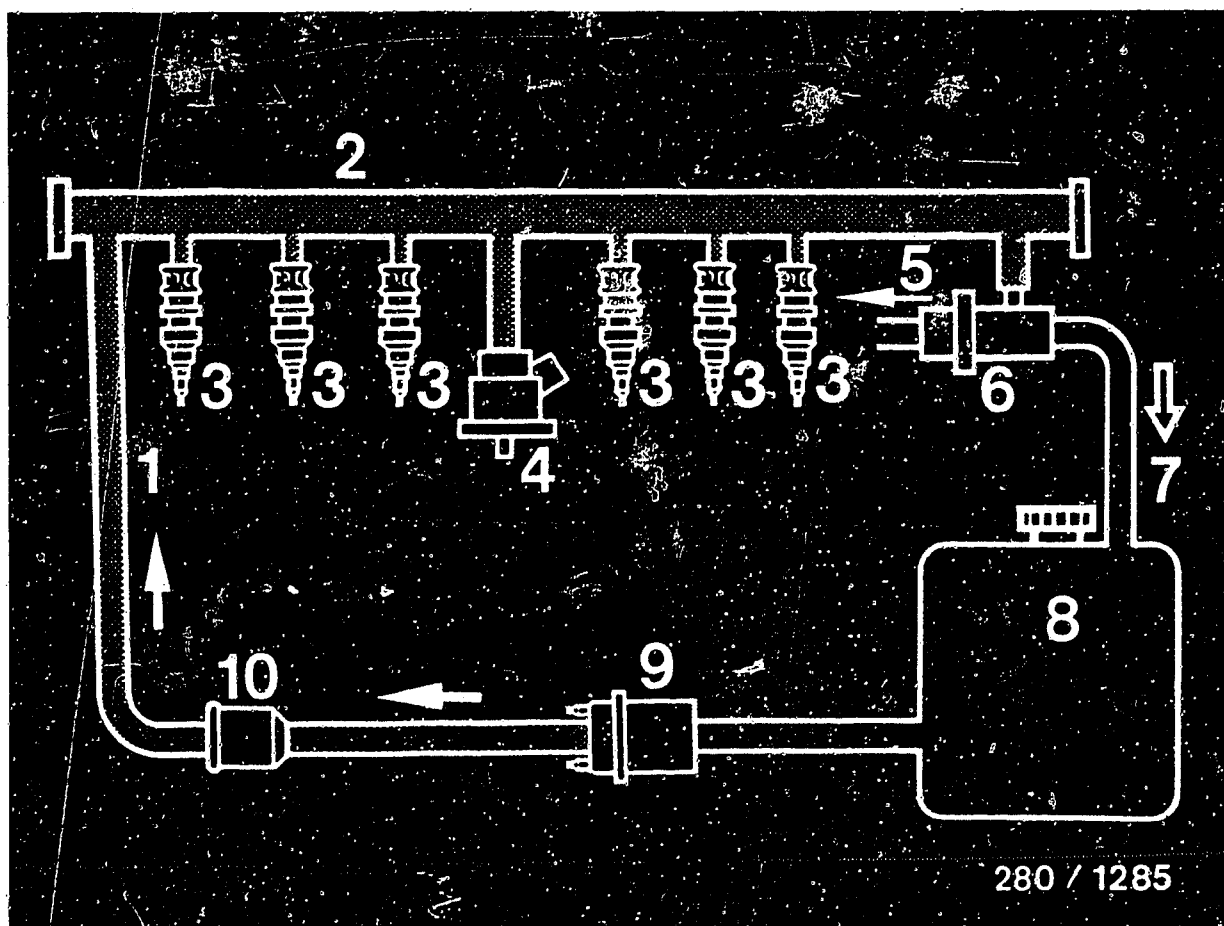


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Terminal diagram

Different US-vehicles with L-Jetronic





Fuel line arrangement (Ex. - 6 cyl. motor)

 pressureless
 fuel pressure

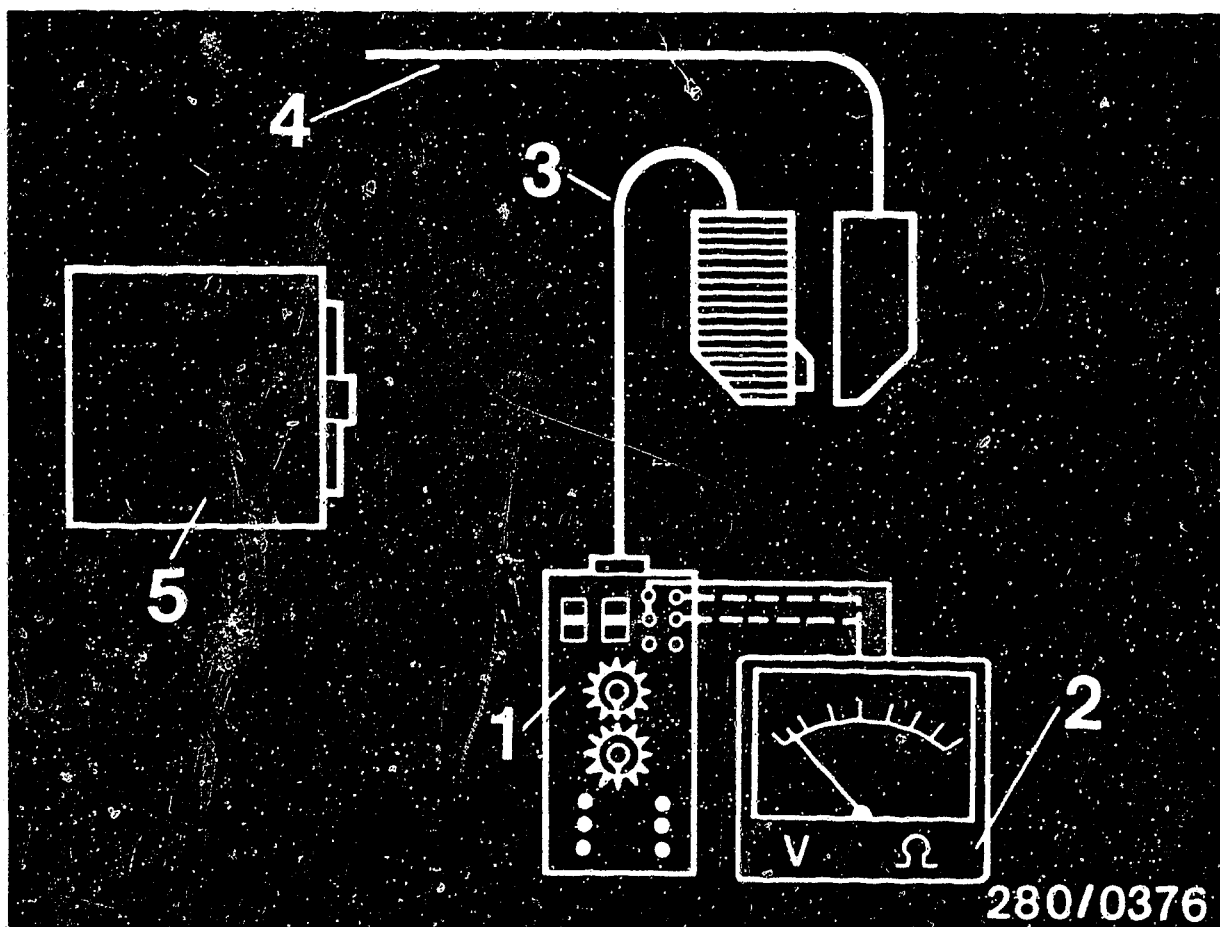
- | | |
|--------------------------------|------------------|
| 1 = Pressure line | 7 = Return line |
| 2 = Fuel distributor | 8 = Fuel tank |
| 3 = Electric injection valves | 9 = Fuel pump |
| 4 = Cold start valve | 10 = Fuel filter |
| 5 = Intake manifold connection | |
| 6 = Pressure regulator | |



TEST EQUIPMENT AND TOOLING

<u>Designation</u>	<u>Type</u>	<u>Order No.</u>
Universal test adapter	ETT 018.01	0 684 101 801
Adapter line		1 684 463 129
Motortester	e.g. MOT 002.00 MOT 300 MOT 400	0 684 000 200 0 684 000 300 0 684 000 400
Test lead	(2-pole Y-cable)	1 684 463 093
Test lead	(2-pole w.plug)	KDJE 7450/70
Test lead		KDZS 0004
Exhaust-gas analyzer, calibrated	e.g. ETT 008.00 ETT 008.04 ETT 008.05	0 684 100 800 0 684 100 804 0 684 100 805
Pressure gauge		KDJE-P 100
Three way line		KDJE-P 100/13
Connection part		KDJE-P 100/14
Lambda closed loop tester		0 684 101 810 (KDJE-P 600)
Electric tester or multimeter (commercially avail.)	ETE 014.00 Philips Miselco Fluke	0 684 101 400 PM 2517 X Master 50K Multimeter 75
Allen screwdriver 5 mm	comm.avail.	e.g. Hahn & Kolb No.52138





1 = Universal test adapter
 2 = Multimeter
 3 = Adapter line (L-Jet)

4 = L-Jet wiring harness
 5 = L-Jet control unit

General

Disconnect the multiple plug of the control unit and connect the multiple plug of the test lead to the wiring harness.

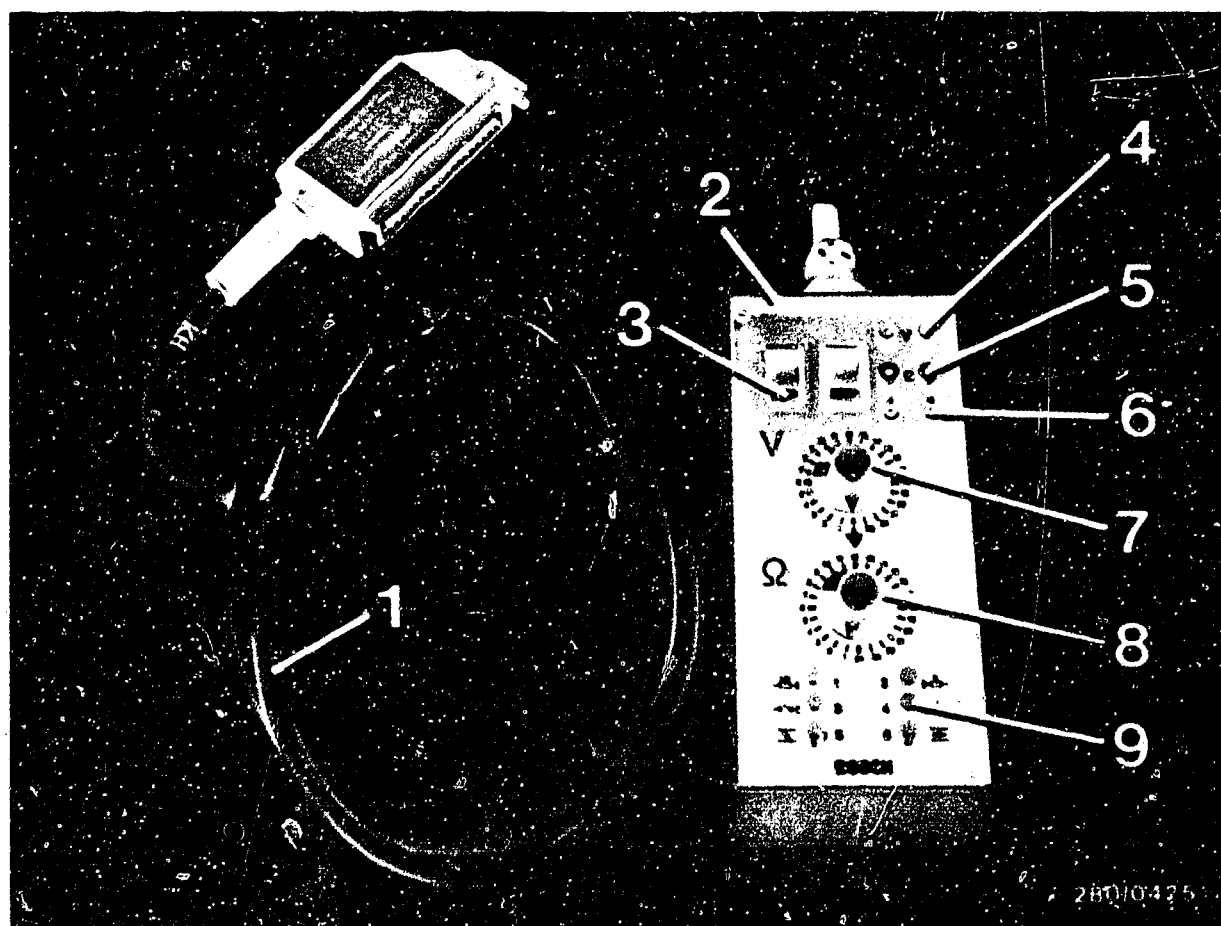
Information

Plug in and remove multiple plug of universal test adapter only when ignition is switched off.

Testing

For testing connect a multimeter with an impedance of more than 20 K Ω /V to the universal test adapter. The signal from term. 1 of the coil (ignition) can be measured by the motortester oscilloscope.





Universal test adapter with adapter line for L-Jetronic

- 1 = Adapter line (Order no.: 1 684 463 129)
- 2 = Universal test adapter (Order no.: 0 684 101 801)
- 3 = Test wells (for motortester)
- 4 = Test socket (for volt metering)
- 5 = Test socket (for resistance metering)
- 6 = Test socket (not yet occupied)
- 7 = Program switch "V"
- 8 = Program switch "Ω"
- 9 = Pushbuttons (not used for L-Jet)



IMPORTANT GENERAL INFORMATION

- Never start the vehicle without the correct battery connection.
- Never use starting aids with more than 16 V or start boosters.
- Don't disconnect the battery with the engine running.
- When boosting the battery disconnect from the electrical system.
- For temperature over +80°C (drying oven) remove the control unit.
- Make sure that all connections on the harness are connected properly.
- Never disconnect the control unit with the ignition on.
- When making compression checks disconnect the relay combination or interrupt the power supply to the ECU so that the power supply for the injection valves is interrupted and unwanted fuel will be prevented.
- When electrical welding or spot welding the L-Jet control unit must be removed.
- The following conditions must be fulfilled when using the rapid test list:
engine is in complete working order and ignition is correctly timed. All necessary repairs have been performed.
- To follow the test procedure of this microcard the operator should have experience in working on L-Jetronic systems.
Essential functions and sectional diagrams of the L-Jet system are described in the Bosch Technical Instructions, no. 1 987 722 010.



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1. SPECIAL FEATURES

This microcard contains the BMW models 535i, M535i, 635CSi, 735i for Europe and Sweden (S), Switzerland (CH), Australia (AUS). All models as of 10.84.

All models are equipped with the Bosch idle-speed control. The idle-speed control is controlled by the Motronic control unit. New functions which are controlled differently, depending on the version of vehicle:

- National variant: influence on lambda and spark-advance maps (except: idle and full-load characteristics) via term. 24 from control unit.
- Driving range switch: influence on idle speed control via term. 28 from control unit
- Linking with electronic transmission control which is supplied as an option in an independent control unit. In this case, full-load enrichment is triggered not by the throttle-valve switch, but through the transmission control unit. Likewise, the transmission control unit influences the spark-advance angle via term. 10 (map switch function). The spark-advance angle is influenced when shifting up and down in order to damp the jerk on shifting and thus to save clutch and transmission.

2. RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the experienced Motronic expert to quickly check the electrical parts of the system with the universal test adapter.

If necessary, the similar microcard SIS-BMW 509 (525e) can be used as an aid.



Rapid diagnosis chart for universal test adapter

Test step	Switch position		Remarks	Test specifications (reading)
	V	Ω		
1	↓	1	Shift gear to neutral. Ignition off. Disconnect Motronic control unit and, if applicable, transmission control unit and pump relay. Control unit on 5 and 6 series in glove compartment; on 7 series in front-passenger footwell on right. Measure insulation resistance of engine-speed sensor term. 8 to term. 5.	<u>greater than 1 MΩ</u>
2	↓	2	Measure insulation resistance of reference-mark sensor term. 25 to term. 5	<u>greater than 1 MΩ</u>
3	↓	3	Measure winding resistance of engine-speed sensor term. 8 to term. 27.	<u>0.6...1.6 kΩ</u>
4	↓	4	Measure winding resistance of reference-mark sensor term. 25 to term. 26.	<u>0.6...1.6 kΩ</u>
5	↓	5	Measure resistance of engine temperature sensor (NTC II) term. 13 to term. 5.	at +15°C to +30°C: <u>1.45...3.3 kΩ</u> (temperature-dependent)
6	↓	6	Measure resistance of air temperature sensor (NTC I) term. 22 to term. 5.	at +15°C to +30°C <u>1.45...3.3 kΩ</u> (temperature-dependent)
7	↓	7	Measure resistance of map switch term. 10 to term. 5.	Manual transmission: <u>less than 10Ω</u> Automatic: <u>$\infty\Omega$</u> Electronic transmission control: <u>see test step 18</u>
8	↓	8	Not applicable	-----
9	↓	9	Accelerator in rest position Actuate accelerator (part-load range) Measure resistance of idle contact term. 2 to term. 5.	<u>less than 10Ω</u> <u>$\infty\Omega$</u>

C3

Rapid diagnosis chart

BMW 535i, M535i, 635CSi, 735i









C4

Rapid diagnosis chart

BMW 535i, M535i, 635CSi, 735i



Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position		Remarks	Test specifications (reading)
	V	Ω		
10		10	Fully depress accelerator. Measure resistance of full-load contact term. 3 to term. 5.	<u>less than 10Ω</u>
			Caution with electronic transmission control. No full-load contact, but full-load enrichment through transmission control unit (term. 31). Tested in test step 43.	
11		11	Switch off ignition. Measure resistance. Ground term. 16 to term. 5.	<u>less than 10Ω</u>
12		12	Measure resistance. Ground term. 17 to term. 5	<u>less than 10Ω</u>
13		13	Measure resistance. Ground term. 19 to term. 5	<u>less than 10Ω</u>
14		14	Not applicable	-----
15		15	Measure resistance. Term. 28 to term. 5.	<u>less than 10Ω</u>
			Manual transmission: Automatic transmission and electronic transmission control: in positions P and N in positions 1, 2, 3 and D _____	<u>less than 10Ω</u> <u>greater than 1 M Ω</u>

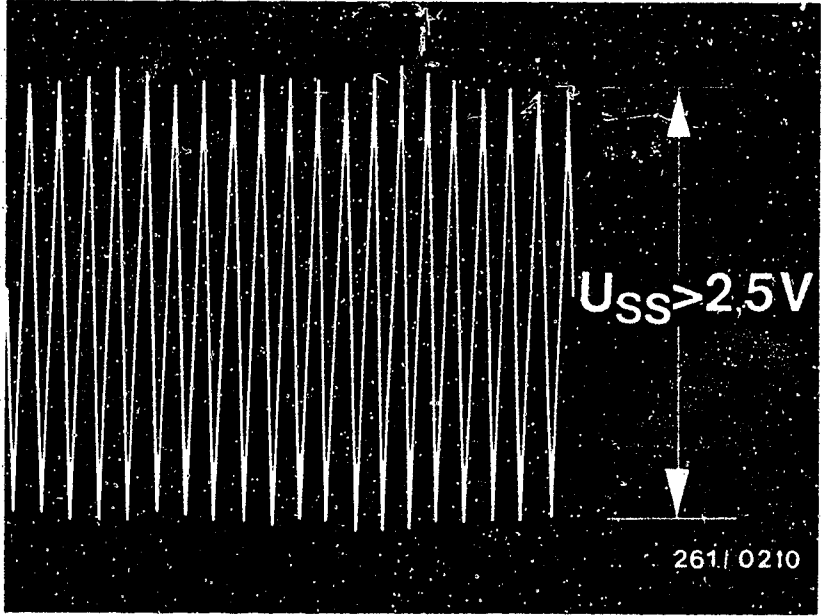
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15

Using oscilloscope, measure signal at engine-speed sensor term. 8 to term. 27. Shift gear to neutral and start.

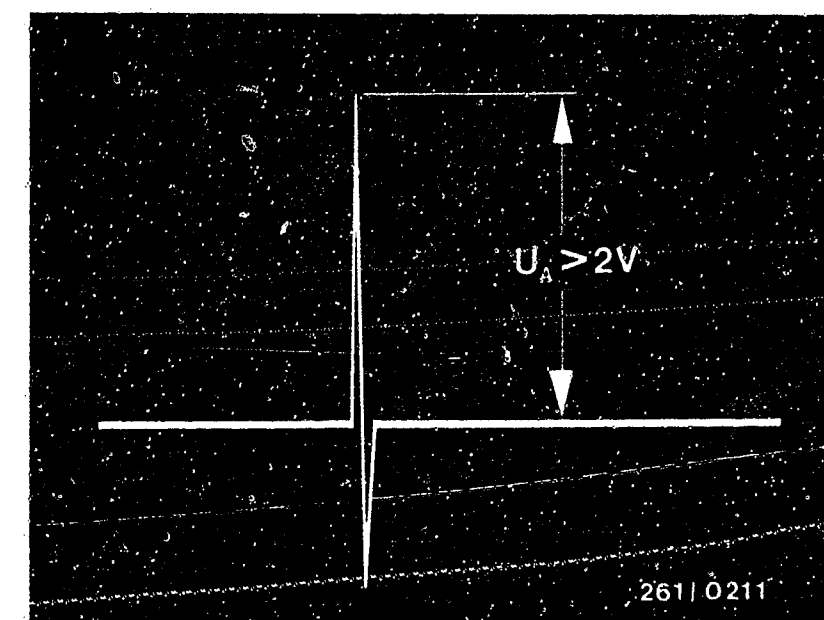
See diagram



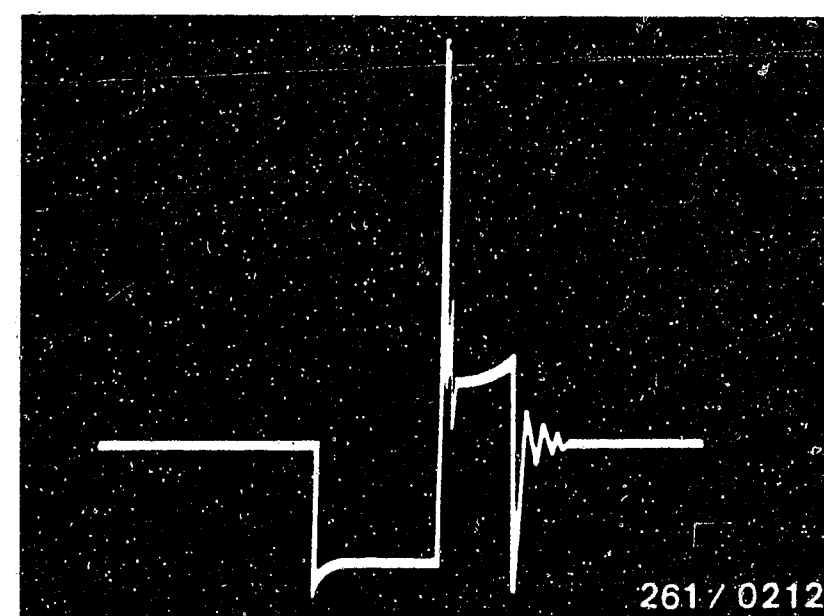
Engine-speed sensor signal

Rapid diagnosis chart for universal test adapter (continued)

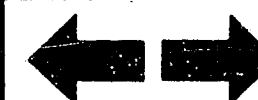
Test step	Switch position		Remarks	Test specifications (reading)
	V	Ω		
17	2	15	Using oscilloscope, measure signal at reference-mark sensor term. 25 to term.26. Shift gear to neutral and start	See top diagram
18	3	15	Test applies only to vehicles with electronic transmission control. Switch off ignition and connect Motronic control unit. Ignition on. Measure voltage at term. 10 and term. 5.	greater than <u>3.5 V</u>
19	4	15	Switch on air conditioner. Measure voltage at term. 29 to term. 5.	greater than <u>8 V</u>
20	6	15	Measure voltage at relay 2 (main relay) term. 35 to term. 5.	<u>10...15 V</u>
21	7	15	Not applicable	-----
22	5	15	Measure ignition signal with oscilloscope. Shift gear to neutral and start. Control unit, ignition output stage term. 1 to term. 5.	See bottom diagram



Reference-mark sensor signal

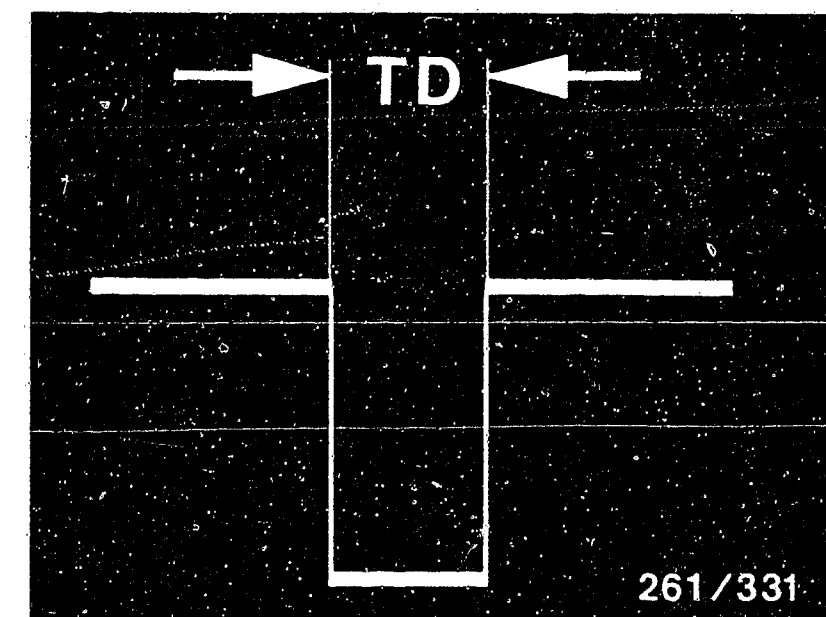


Ignition signal



Rapid diagnosis chart for universal test adapter (continued)

<u>Test step</u>	<u>Switch position</u>		<u>But-ton</u>	<u>Remarks</u>	<u>Test specifications (reading)</u>
	V				
23	8	15		Measure voltage at control unit term. 9 to term. 5.	<u>greater than 4.5 V</u>
24	9	15		Measure voltage at air-flow sensor term. 7 to term. 5 Sensor flap in rest position:	<u>200...300 mV</u>
				Sensor flap fully open:	<u>greater than 4.2 V</u>
25/26	10/11	15		Not applicable	-----
27	12	15		Measure voltage. Starting signal term. 50. Shift gear to neutral and start. Term. 4 to term. 5.	<u>8...15 V</u>
28	13	15		Check dwell-period signal TD from control unit with oscilloscope. Term. 21 to term. 5. Shift gear to neutral and start.	<u>See diagram</u>

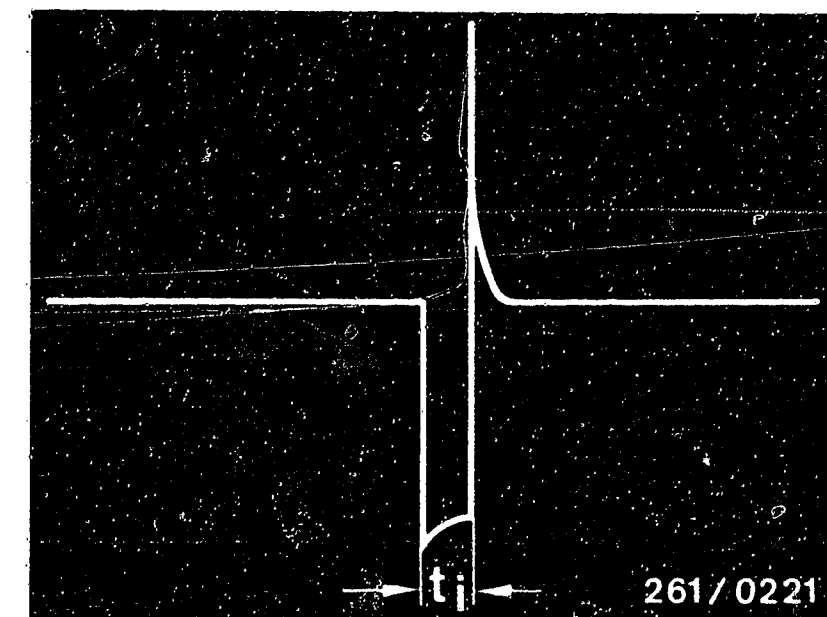


TD=Dwell-period signal

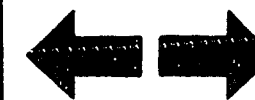
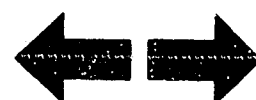


Rapid diagnosis chart for universal test adapter (continued)

<u>Test step</u>	<u>Switch position</u>		<u>But-ton</u>	<u>Remarks</u>	<u>Test specifications (reading)</u>
	V	Ω			
29	14	15		Check injection signal t_i from control unit with oscilloscope term. 14 to term. 5. Shift gear to neutral and start.	See top diagram
30	14	15	T1	As 29, but after pressing button (NTC II, cold) duration of injection becomes slightly longer. (Engine speed rises to above 1500 min^{-1})	
31	15	15		As test step 29, but check term. 15 to term. 5.	
32	16	15		Check duration of injection t_i from control unit with oscilloscope term. 11 to term. 5. Shift gear to neutral and start.	



Injection signal
 t_i = duration of injection



Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position		But-ton	Remarks	Test specifications (reading)
	V	Ω			
33	17	15		Connect pump relay. Measure voltage at pump relay term. 20 to term. 5. Switch on ignition.	<u>10...15 V</u>
34	17	15		Measure voltage. Shift gear to neutral and start. Control unit, active pump control. Term. 20 to term. 5.	<u>max. 4 V</u>
35	17	15	T3	Ignition off. Connect pressure gauge. Switch on ignition. Press button T3. Read off fuel pressure.	<u>2.3...2.7 bar</u>
36	17	15		Connect motortester and diagnosis cable (1 684 463 095). Connect CO analyzer. Let engine run. Check idle speed and CO.	<u>750...850 min⁻¹</u>
	17	15	T2	As above, readings unchanged.	<u>0.5...1.5 Vol.% CO</u> <u>S/CH/AUS: 0.3...0.7Vol%C</u>
37	17	15		Let engine run. Check spark advance at idle speed. Important: ensure idle speed 750...850 min ⁻¹ , otherwise different spark-advance angles will be indicated.	<u>3°...13°</u> <u>S/CH/AUS: 5°...-5°</u>
	17	15	T6	Check spark-advance at full load. Set engine speed to 2000 min ⁻¹ and press T6 (full-load button). Caution with vehicles with electronic transmission control: before checking, be sure to disconnect transmission control unit (to do this, switch off ignition).	<u>20°...30° at engine speed 2000 min⁻¹</u>
38	17	15		Dwell angle at idle speed	<u>6°...18°</u>
				Dwell angle at 2700 min ⁻¹	<u>22°...42°</u>
39	17	15	T5	Keep engine speed constant at 2000 min ⁻¹ . Press button T5. Injection signals stop and start again at approx. 1200 min ⁻¹ .	<u>Engine "hunts"</u>

C13

Rapid diagnosis chart
BMW 535i, M535i, 636CSi, 735i



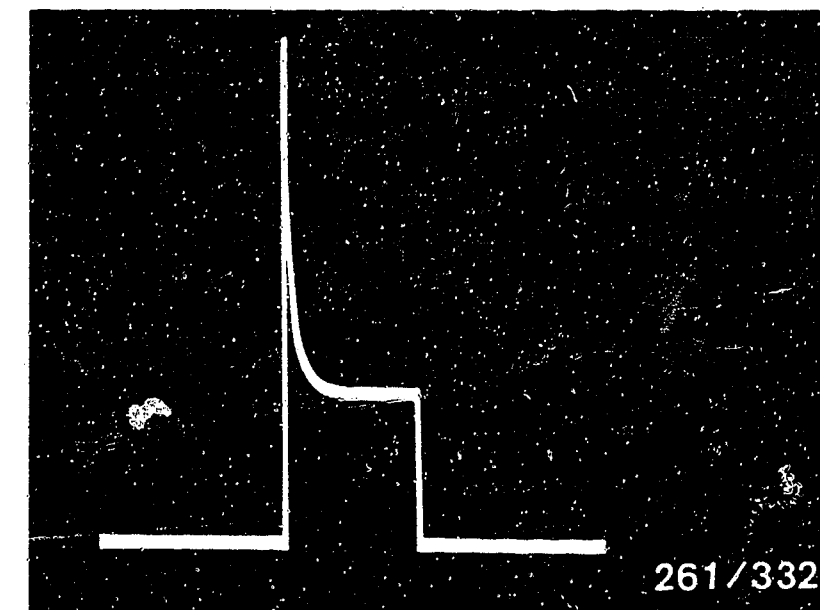
C14

Rapid diagnosis chart
BMW 535i, M535i, 636CSi, 735i



Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position		But-ton	Remarks	Test specifications (reading)
	V	Ω			
40	18	15	T5 and T6	Check on/off ratio of idle-speed control term. 33 to term. 5 with dwell-angle tester (% scale) and oscilloscope (special input). Clip term. 15 of motortester to red well. Disconnect transmission control unit. Press buttons T5 and T6 simultaneously. Read off test specifications. If necessary, correct idle speed at throttle-valve stop to 750...800 min ⁻¹ and re-adjust throttle-valve switch.	55%...65% (See top diagram for signal shape) S/CH/AUS: 51%...61%
41	19	15	T5 and T6	As test step 40, but term. 34 to term. 5.	35%...45% (See top diagram for signal shape) S/CH/AUS: 39%...49%
42	21	15		For Europe: term. 24 open	approx. 5 V
				For S/CH/AUS: term. 24 to ground through +45°C thermo-switch and speedometer. Test possible only on chassis dynamometer at speed greater than 65 km/h and with engine at operating temperature. Re-connect transmission control unit. To do this, switch off ignition.	0 V with engine greater than 45°C and v greater than 65 km/h
43	↓	10		Test step applies only to vehicles with electronic transmission control. Caution: voltage measurement at ohm sockets. Switch over multimeter to voltage measurement. Connect transmission control unit. Disconnect pump relay. Selector switch in position P. Do not press accelerator.	1. After brief starting, do not switch off ignition: greater than 2 V 2. Fully depress accelerator: less than 1 V



Signal at idle actuator



3. TEST SPECIFICATIONS

● <u>Idle speed:</u>	<u>750...850 min⁻¹</u>
● <u>Exhaust-gas setting:</u> CO concentration with engine at normal operating temperature, all electrical devices off S/CH/AUS:	<u>0.5...1.5 Vol.%CO</u> <u>0.3...0.7 Vol.%CO</u>
● <u>Fuel pressure:</u>	<u>2,8...3,2 bar</u>
● <u>Fuel pump delivery:</u>	<u>min. 950 cm³/30 s</u>
● <u>Solenoid-operated injection valve</u> Electrical internal resistance at +20°C:	<u>15.0...17.5 Ω</u>
● <u>Air-flow sensor</u> Resistance between term. 7 and term. 6: Term. 9 and term. 6:	<u>8 Ω ... 2500 Ω</u> (Deflect sensor flap) <u>500 Ω ... 1100 Ω</u>
● <u>Idle actuator</u> Electrical internal resistance at +15°C to +30°C Term. 2 and term. 3 Term. 2 and term. 1	<u>17...22.5 Ω</u> <u>19...25 Ω</u>

See equipment and Autodata microcards for settings for valve clearance and other engine data.



Temperature sensor I (NTC I air):

Electrical internal resistance

at +15°C...+30°C:

1.45...3.3 kΩ

(measured at air-flow sensor
between term. 22 and term. 6)

at +80°C:

280...360 Ω

Temperature sensor II (NTC II, coolant):

Electrical internal resistance

at +15°C...+30°C:

1.3...3.6 kΩ

at +80°C:

250...390 Ω

Engine-speed sensor and reference-mark sensor

Electrical internal resistance

0.6...1.6 kΩ

Throttle-valve switch

Resistance of idle contact

(term. 2 and 18)

0 Ω

Full-load contact (term. 3 and 18):

0 Ω

Note: with electronic transmission control, no full-load contact, but full-load enrichment through transmission control unit (term. 31).

Idle contact through microswitch or throttle-valve sensor term. 4 and term. 6 (6-pin plug).

Start valve

Electrical internal resistance:

approx. 4 Ω

Thermo-time switch Electrical internal resistance:

35°C/8s

"G" and
ground

"W" and
ground

"G" and
"W"

Ambient temp.
(below +30°C):

25...40 Ω

0 Ω

25...40 Ω

at op. temp.

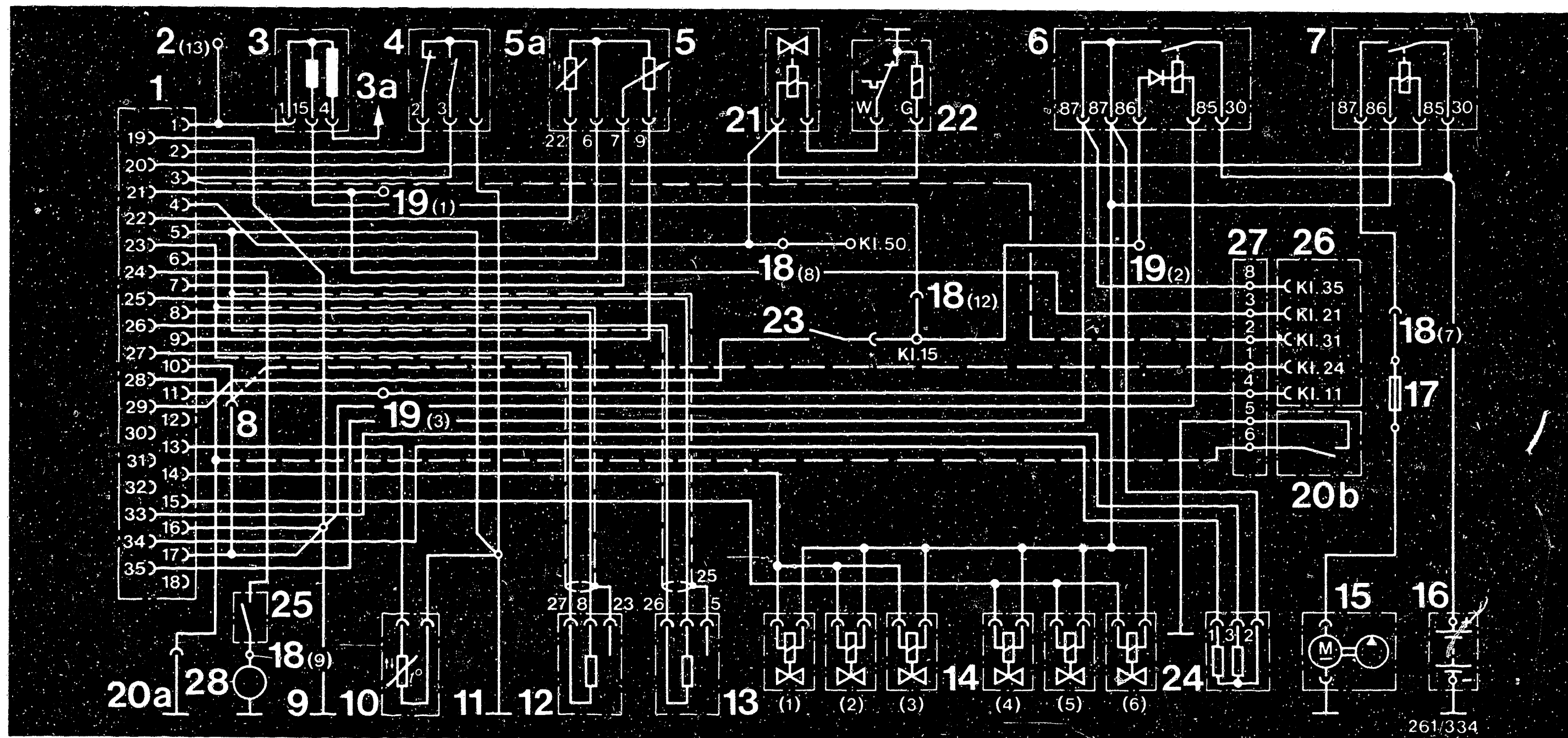
(above +40°C)

50...80 Ω

100...160 Ω

50...80 Ω

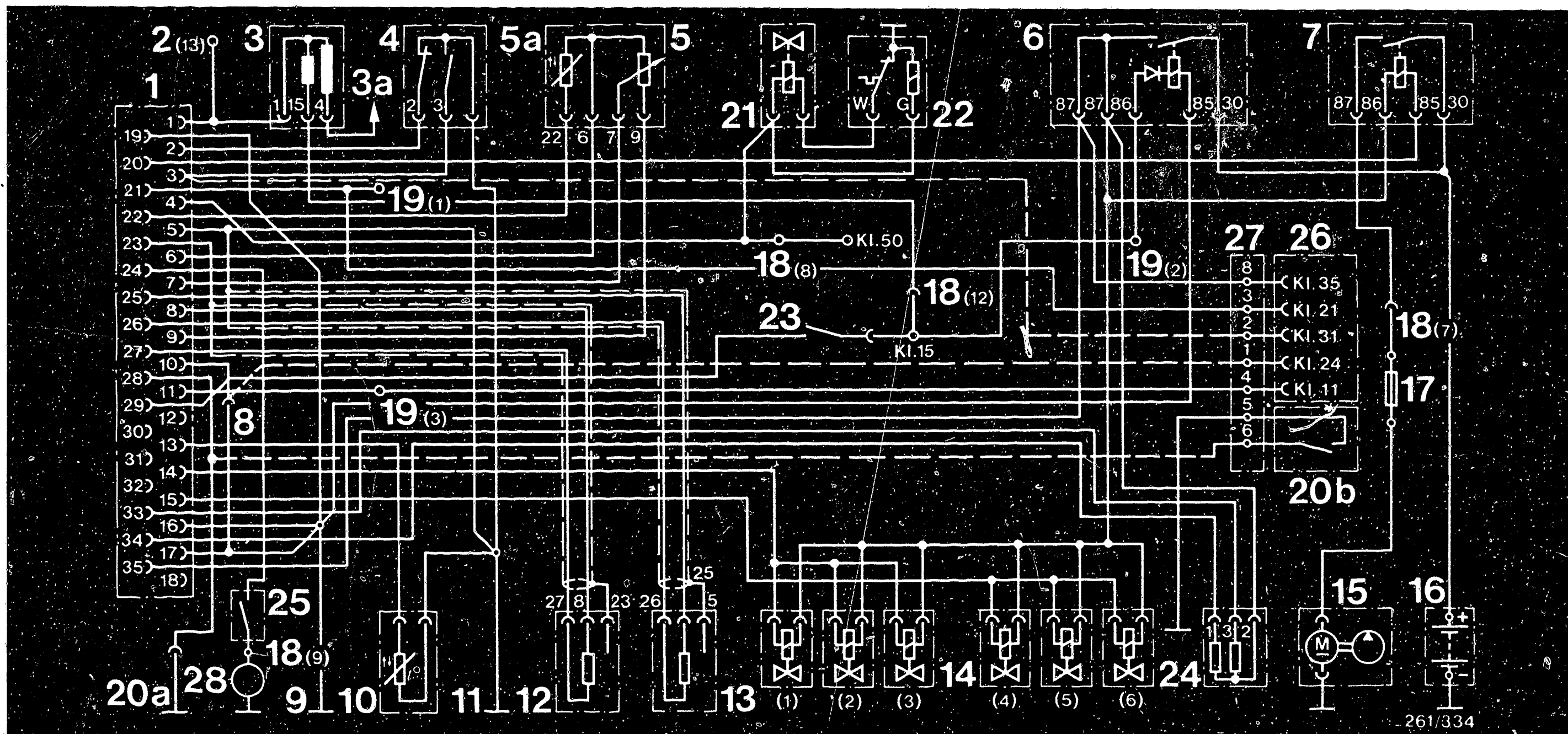




4. ELECTRICAL TERMINAL DIAGRAM

- | | | |
|---|--|--|
| 1 = Motronic control-unit plug | 5a = Temperature sensor I (air) | 9 = Vehicle ground for control unit output stage |
| 2 = Diagnosis plug (No. 13) | 6 = Relay 2 (main relay with incorrect-polarity protection diode) | 10 = Coolant temperature sensor |
| 3 = Ignition coil | 7 = Relay 1 (pump relay) | 11 = Vehicle ground for control unit |
| 3a = To high-voltage distributor | 8 = Plug connector connected for manual transmission (open for automatic transmission) | 12 = Engine-speed sensor |
| 4 = Throttle-valve switch (no full-load contact with electronic transmission control) | | 13 = Reference-mark sensor |
| 5 = Air-flow sensor | | 14 = Injection valves |





Electrical terminal diagram (continued)

- 15 = Fuel pump
- 16 = Battery
- 17 = Pump fuse F1
- 18 = Engine plug (No. 7,8,9,12)
- 19 = Plug connector (6-pin No. 1,2,3 in glove compartment)
- 20a = Automatic: plug connector open. Manual transmission: plug connector connected

- 20b = Automatic and electronic transmission control:
In positions P and N to ground
In positions D, 1,2 and 3 open.
- 21 = Start valve
- 22 = Thermo-time switch
- 23 = Air conditioner switch
- 24 = Idle actuator

- 25 = Thermo-switch +45°C only for S/CH/AUS. (For rest of Europe term. 24 not used)
- 26 = Electronic transmission control unit
- 27 = Plug connector (13 pin) in glove compartment
- 28 = Speedometer



5. IMPORTANT GENERAL INFORMATION

Be sure to follow these instructions in order to prevent damage to engine, control unit and ignition coil and to prevent risk to persons.

5.1 Never start engine without securely connected battery.

5.2 Incorrect polarity of supply voltage, e.g. through incorrect connection of battery or ignition coil, may lead to destruction of control unit.

5.3 'Do not use a fast charger for starting the engine.

For starting assistance, use only second 12 V battery and jump leads.

Caution: Due to non-standardized requirements of vehicle manufacturers as regards electronic products, we advise you not to use a 24 V battery for starting assistance. Follow owner's manual of vehicle.

5.4 Disconnect battery from vehicle electrical system before fast charging.

5.5 If charging the battery in the vehicle or if rendering starting assistance, follow the instructions in the operating instructions for the fast charger as well as the instructions of the vehicle manufacturer.

5.6 Never disconnect the battery from the vehicle electrical system with the engine running.



5.7 Do not short-circuit ignition coil term. 1 to ground (e.g. for stopping the engine). Ignition coil and, possibly, control unit will be destroyed.

5.8 Never connect positive pole of battery to ignition coil term. 1. Control unit will be destroyed.

5.9 Never disconnect or connect wiring-harness plug of control unit with ignition on.

5.10 Remove the control unit at temperatures above +80°C (paint-drying installation).

5.11 Remove the control unit before carrying out welding work (electric spot welding).

5.12 When testing compression, disconnect the main relay. This prevents undesired injecting through the injection valves.

5.13 If an alarm system is installed, follow the information in installation instructions for Motronic vehicles or SIS microcard ALL-500.

It must be ensured that the alarm relay is not disturbed by extraneous fields (e.g. by ignition cables), causing it to trip incorrectly.

5.14

Caution!

High-energy ignition system; dangerous voltages on primary and secondary sides.

Contact with live parts or terminals may be extremely dangerous (both on the primary as well as on the secondary sides).

